

## SEQUENCE LISTING

<110> STEELE, Christopher L.  
DIXON, Richard A.

<120> GENETIC MANIPULATION OF ISOFLAVONOIDS

<130> 11137/05006

<140> PCT/US00/05915

<141> 2000-08-03

<150> 60/123,267

<151> 1999-03-08

<160> 5

<170> PatentIn Ver. 2.1

<210> 1

<211> 1717

<212> DNA

<213> Glycine max

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<221> CDS

<222> (36)..(1598)

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Leu Gly Leu Leu Val Leu Ala Leu Phe Leu His Leu Arg Pro Thr Pro
                               10              15              20

act gca aaa tca aaa gca ctt cgc cat ctc cca aac cca cca agc cca      149
Thr Ala Lys Ser Lys Ala Leu Arg His Leu Pro Asn Pro Pro Ser Pro
                               25              30              35

aag cct cgt ctt ccc ttc ata gga cac ctt cat ctc tta aaa gac aaa      197
Lys Pro Arg Leu Pro Phe Ile Gly His Leu His Leu Leu Lys Asp Lys
                               40              45              50

ctt ctc cac tac gca ctc atc gac ctc tcc aaa aaa cat ggt ccc tta      245
Leu Leu His Tyr Ala Leu Ile Asp Leu Ser Lys Lys His Gly Pro Leu
                               55              60              65              70

ttc tct ctc tac ttt ggc tcc atg cca acc gtt gtt gcc tcc aca cca      293
Phe Ser Leu Tyr Phe Gly Ser Met Pro Thr Val Val Ala Ser Thr Pro
                               75              80              85

gaa ttg ttc aag ctc ttc ctc caa acg cac gag gca act tcc ttc aac      341
Glu Leu Phe Lys Leu Phe Leu Gln Thr His Glu Ala Thr Ser Phe Asn
                               90              95              100

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aca agg ttc caa acc tca gcc ata aga cgc ctc acc tat gat agc tca 389  
 Thr Arg Phe Gln Thr Ser Ala Ile Arg Arg Leu Thr Tyr Asp Ser Ser  
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gtg gcc atg gtt ccc ttc gga cct tac tgg aag ttc gtg agg aag ctc 437  
 Val Ala Met Val Pro Phe Gly Pro Tyr Trp Lys Phe Val Arg Lys Leu  
 120 125 130

atc atg aac gac ctt ctc aac gcc acc act gta aac aag ttg agg cct 485  
 Ile Met Asn Asp Leu Leu Asn Ala Thr Thr Val Asn Lys Leu Arg Pro  
 135 140 145 150

ttg agg acc caa cag atc cgc aag ttc ctt agg gtt atg gcc caa ggc 533  
 Leu Arg Thr Gln Gln Ile Arg Lys Phe Leu Arg Val Met Ala Gln Gly  
 155 160 165

gca gag gca cag aag ccc ctt gac ttg acc gag gag ctt ctg aaa tgg 581  
 Ala Glu Ala Gln Lys Pro Leu Asp Leu Thr Glu Glu Leu Leu Lys Trp  
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acc aac agc acc atc tcc atg atg atg ctc ggc gag gct gag gag atc 629  
 Thr Asn Ser Thr Ile Ser Met Met Met Leu Gly Glu Ala Glu Glu Ile  
 185 190 195

aga gac atc gct cgc gag gtt ctt aag atc ttt ggc gaa tac agc ctc 677  
 Arg Asp Ile Ala Arg Glu Val Leu Lys Ile Phe Gly Glu Tyr Ser Leu  
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act gac ttc atc tgg cca ttg aag cat ctc aag gtt gga aag tat gag 725  
 Thr Asp Phe Ile Trp Pro Leu Lys His Leu Lys Val Gly Lys Tyr Glu  
 215 220 225 230

aag agg atc gac gac atc ttg aac aag ttc gac cct gtc gtt gaa agg 773  
 Lys Arg Ile Asp Asp Ile Leu Asn Lys Phe Asp Pro Val Val Glu Arg  
 235 240 245

gtc atc aag aag cgc cgt gag atc gtg agg agg aga aag aac gga gag 821  
 Val Ile Lys Lys Arg Arg Glu Ile Val Arg Arg Arg Lys Asn Gly Glu  
 250 255 260

gtt gtt gag ggt gag gtc agc ggg gtt ttc ctt gac act ttg ctt gaa 869  
 Val Val Glu Gly Glu Val Ser Gly Val Phe Leu Asp Thr Leu Leu Glu  
 265 270 275

ttc gct gag gat gag acc atg gag atc aaa atc acc aag gac cac atc 917  
 Phe Ala Glu Asp Glu Thr Met Glu Ile Lys Ile Thr Lys Asp His Ile  
 280 285 290

aag ggt ctt gtt gtc gac ttt ttc tcg gca gga aca gac tcc aca gcg 965  
 Lys Gly Leu Val Val Asp Phe Phe Ser Ala Gly Thr Asp Ser Thr Ala  
 295 300 305 310

gtg gca aca gag tgg gca ttg gca gaa ctc atc aac aat cct aag gtg 1013  
 Val Ala Thr Glu Trp Ala Leu Ala Glu Leu Ile Asn Asn Pro Lys Val  
 315 320 325

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ctt gtg gac gaa gtt gac act caa aac ctt cct tac att aga gca atc 1109  
 Leu Val Asp Glu Val Asp Thr Gln Asn Leu Pro Tyr Ile Arg Ala Ile  
 345 350 355

gtg aag gag aca ttc cgc atg cac ccg cca ctc cca gtg gtc aaa aga 1157  
 Val Lys Glu Thr Phe Arg Met His Pro Pro Leu Pro Val Val Lys Arg  
 360 365 370

aag tgc aca gaa gag tgt gag att aat gga tat gtg atc cca gag gga 1205  
 Lys Cys Thr Glu Glu Cys Glu Ile Asn Gly Tyr Val Ile Pro Glu Gly  
 375 380 385 390

gca ttg att ctc ttc aat gta tgg caa gta gga aga gac ccc aaa tac 1253  
 Ala Leu Ile Leu Phe Asn Val Trp Gln Val Gly Arg Asp Pro Lys Tyr  
 395 400 405

tgg gac aga cca tcg gag ttc cgt cct gag agg ttc cta gag aca ggg 1301  
 Trp Asp Arg Pro Ser Glu Phe Arg Pro Glu Arg Phe Leu Glu Thr Gly  
 410 415 420

gct gaa ggg gaa gca ggg cct ctt gat ctt agg gga caa cat ttt caa 1349  
 Ala Glu Gly Glu Ala Gly Pro Leu Asp Leu Arg Gly Gln His Phe Gln  
 425 430 435

ctt ctc cca ttt ggg tct ggg agg aga atg tgc cct gga gtc aat ctg 1397  
 Leu Leu Pro Phe Gly Ser Gly Arg Arg Met Cys Pro Gly Val Asn Leu  
 440 445 450

gct act tcg gga atg gca aca ctt ctt gca tct ctt att cag tgc ttc 1445  
 Ala Thr Ser Gly Met Ala Thr Leu Leu Ala Ser Leu Ile Gln Cys Phe  
 455 460 465 470

gac ttg caa gtg ctg ggt cca caa gga cag ata ttg aag ggt ggt gac 1493  
 Asp Leu Gln Val Leu Gly Pro Gln Gly Gln Ile Leu Lys Gly Gly Asp  
 475 480 485

gcc aaa gtt agc atg gaa gag aga gcc ggc ctc act gtt cca agg gca 1541  
 Ala Lys Val Ser Met Glu Glu Arg Ala Gly Leu Thr Val Pro Arg Ala  
 490 495 500

cat agt ctt gtc tgt gtt cca ctt gca agg atc ggc gtt gca tct aaa 1589  
 His Ser Leu Val Cys Val Pro Leu Ala Arg Ile Gly Val Ala Ser Lys  
 505 510 515

ctc ctt tct taattaagat catcgtcatc atcatcatat gtaatatatta 1638  
 Leu Leu Ser  
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tatataagcc cttccatgc 1717

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           20           25           30

Pro Asn Pro Pro Ser Pro Lys Pro Arg Leu Pro Phe Ile Gly His Leu
           35           40           45

His Leu Leu Lys Asp Lys Leu Leu His Tyr Ala Leu Ile Asp Leu Ser
           50           55           60

Lys Lys His Gly Pro Leu Phe Ser Leu Tyr Phe Gly Ser Met Pro Thr
           65           70           75           80

Val Val Ala Ser Thr Pro Glu Leu Phe Lys Leu Phe Leu Gln Thr His
           85           90           95

Glu Ala Thr Ser Phe Asn Thr Arg Phe Gln Thr Ser Ala Ile Arg Arg
           100          105          110

Leu Thr Tyr Asp Ser Ser Val Ala Met Val Pro Phe Gly Pro Tyr Trp
           115          120          125

Lys Phe Val Arg Lys Leu Ile Met Asn Asp Leu Leu Asn Ala Thr Thr
           130          135          140

Val Asn Lys Leu Arg Pro Leu Arg Thr Gln Gln Ile Arg Lys Phe Leu
           145          150          155          160

Arg Val Met Ala Gln Gly Ala Glu Ala Gln Lys Pro Leu Asp Leu Thr
           165          170          175

Glu Glu Leu Leu Lys Trp Thr Asn Ser Thr Ile Ser Met Met Met Leu
           180          185          190

Gly Glu Ala Glu Glu Ile Arg Asp Ile Ala Arg Glu Val Leu Lys Ile
           195          200          205

Phe Gly Glu Tyr Ser Leu Thr Asp Phe Ile Trp Pro Leu Lys His Leu
           210          215          220

Lys Val Gly Lys Tyr Glu Lys Arg Ile Asp Asp Ile Leu Asn Lys Phe
           225          230          235          240

Asp Pro Val Val Glu Arg Val Ile Lys Lys Arg Arg Glu Ile Val Arg
           245          250          255

Arg Arg Lys Asn Gly Glu Val Val Glu Gly Glu Val Ser Gly Val Phe
           260          265          270

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Leu Asp Thr Leu Leu Glu Phe Ala Glu Asp Glu Thr Met Glu Ile Lys  
 275 280 285  
 Ile Thr Lys Asp His Ile Lys Gly Leu Val Val Asp Phe Phe Ser Ala  
 290 295 300  
 Gly Thr Asp Ser Thr Ala Val Ala Thr Glu Trp Ala Leu Ala Glu Leu  
 305 310 315 320  
 Ile Asn Asn Pro Lys Val Leu Glu Lys Ala Arg Glu Glu Val Tyr Ser  
 325 330 335  
 Val Val Gly Lys Asp Arg Leu Val Asp Glu Val Asp Thr Gln Asn Leu  
 340 345 350  
 Pro Tyr Ile Arg Ala Ile Val Lys Glu Thr Phe Arg Met His Pro Pro  
 355 360 365  
 Leu Pro Val Val Lys Arg Lys Cys Thr Glu Glu Cys Glu Ile Asn Gly  
 370 375 380  
 Tyr Val Ile Pro Glu Gly Ala Leu Ile Leu Phe Asn Val Trp Gln Val  
 385 390 395 400  
 Gly Arg Asp Pro Lys Tyr Trp Asp Arg Pro Ser Glu Phe Arg Pro Glu  
 405 410 415  
 Arg Phe Leu Glu Thr Gly Ala Glu Gly Glu Ala Gly Pro Leu Asp Leu  
 420 425 430  
 Arg Gly Gln His Phe Gln Leu Leu Pro Phe Gly Ser Gly Arg Arg Met  
 435 440 445  
 Cys Pro Gly Val Asn Leu Ala Thr Ser Gly Met Ala Thr Leu Leu Ala  
 450 455 460  
 Ser Leu Ile Gln Cys Phe Asp Leu Gln Val Leu Gly Pro Gln Gly Gln  
 465 470 475 480  
 Ile Leu Lys Gly Gly Asp Ala Lys Val Ser Met Glu Glu Arg Ala Gly  
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 Leu Thr Val Pro Arg Ala His Ser Leu Val Cys Val Pro Leu Ala Arg  
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 Ile Gly Val Ala Ser Lys Leu Leu Ser  
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&lt;400&gt; 3

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Cys Tyr Phe Phe Phe Arg Pro Tyr Phe His Arg Tyr Gly Lys Asn Leu
      20          25          30

Pro Pro Ser Pro Phe Phe Arg Leu Pro Ile Ile Gly His Met His Met
      35          40          45

Leu Gly Pro Leu Leu His Gln Ser Phe His Asn Leu Ser His Arg Tyr
 50          55          60

Gly Pro Leu Phe Ser Leu Asn Phe Gly Ser Val Leu Cys Val Val Ala
 65          70          75          80

Ser Thr Pro His Phe Ala Lys Gln Leu Leu Gln Thr Asn Glu Leu Ala
      85          90          95

Phe Asn Cys Arg Ile Glu Ser Thr Ala Val Lys Lys Leu Thr Tyr Glu
      100          105          110

Ser Ser Leu Ala Phe Ala Pro Tyr Gly Asp Tyr Trp Arg Phe Ile Lys
      115          120          125

Lys Leu Ser Met Asn Glu Leu Leu Gly Ser Arg Ser Ile Asn Asn Phe
      130          135          140

Gln His Leu Arg Ala Gln Glu Thr His Gln Leu Leu Arg Leu Leu Ser
      145          150          155          160

Asn Arg Ala Arg Ala Phe Glu Ala Val Asn Ile Thr Glu Glu Leu Leu
      165          170          175

Lys Leu Thr Asn Asn Val Ile Ser Ile Met Met Val Gly Glu Ala Glu
      180          185          190

Glu Ala Arg Asp Val Val Arg Asp Val Thr Glu Ile Phe Gly Glu Phe
      195          200          205

Asn Val Ser Asp Phe Ile Trp Leu Phe Lys Lys Met Asp Leu Gln Gly
      210          215          220

Phe Gly Lys Arg Ile Glu Asp Leu Phe Gln Arg Phe Asp Thr Leu Val
      225          230          235          240

Glu Arg Ile Ile Ser Lys Arg Glu Gln Thr Arg Lys Asp Arg Arg Arg
      245          250          255

Asn Gly Lys Lys Gly Glu Gln Gly Ser Gly Asp Gly Ile Arg Asp Phe
      260          265          270

Leu Asp Ile Leu Leu Asp Cys Thr Glu Asp Glu Asn Ser Glu Ile Lys
      275          280          285

Ile Gln Arg Val His Ile Lys Ala Leu Ile Met Asp Phe Phe Thr Ala
      290          295          300

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Gly Thr Asp Thr Thr Ala Ile Ser Thr Glu Trp Ala Leu Val Glu Leu  
 305 310 315 320  
 Val Lys Lys Pro Ser Val Leu Gln Lys Val Arg Glu Glu Ile Asp Asn  
 325 330 335  
 Val Val Gly Lys Asp Arg Leu Val Glu Glu Ser Asp Cys Pro Asn Leu  
 340 345 350  
 Pro Tyr Leu Gln Ala Ile Leu Lys Glu Thr Phe Arg Leu His Pro Pro  
 355 360 365  
 Val Pro Met Val Thr Arg Arg Cys Val Ala Glu Cys Thr Val Glu Asn  
 370 375 380  
 Tyr Val Ile Pro Glu Asp Ser Leu Leu Phe Val Asn Val Trp Ser Ile  
 385 390 395 400  
 Gly Arg Asn Pro Lys Phe Trp Asp Asn Pro Leu Glu Phe Arg Pro Glu  
 405 410 415  
 Arg Phe Leu Lys Leu Glu Gly Asp Ser Ser Gly Val Val Asp Val Arg  
 420 425 430  
 Gly Ser His Phe Gln Leu Leu Pro Phe Gly Ser Gly Arg Arg Met Cys  
 435 440 445  
 Pro Gly Val Ser Leu Ala Met Gln Glu Val Pro Ala Leu Leu Gly Ala  
 450 455 460  
 Ile Ile Gln Cys Phe Asp Phe His Val Val Gly Pro Lys Gly Glu Ile  
 465 470 475 480  
 Leu Lys Gly Asp Asp Ile Val Ile Asn Val Asp Glu Arg Pro Gly Leu  
 485 490 495  
 Thr Ala Pro Arg Ala His Asn Leu Val Cys Val Pro Val Asp Arg Thr  
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 Ser Gly Gly Gly Pro Leu Lys Ile Ile Glu Cys  
 515 520

&lt;210&gt; 4

&lt;211&gt; 1811

&lt;212&gt; DNA

<213> *Medicago truncatula*

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (92)..(1657)

&lt;400&gt; 4

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                               Met Leu Val Glu Leu Ala Val
                               1                               5

act cta ttg ctc att gct ctc ttc tta cac ttg cgt cca aca cct act 160
Thr Leu Leu Leu Ile Ala Leu Phe Leu His Leu Arg Pro Thr Pro Thr
      10                               15                               20

gca aaa tca aag gct ctt cgc cac ctt cca aat cca cca agc cct aaa 208
Ala Lys Ser Lys Ala Leu Arg His Leu Pro Asn Pro Pro Ser Pro Lys
      25                               30                               35

cca cgt ctt cca ttc ata ggt cat ctt cac ctt ttg gat aac cca ctt 256
Pro Arg Leu Pro Phe Ile Gly His Leu His Leu Leu Asp Asn Pro Leu
      40                               45                               50                               55

ctt cac cac act ctt atc aag tta gga aag cgt tat ggc cct ttg tac 304
Leu His His Thr Leu Ile Lys Leu Gly Lys Arg Tyr Gly Pro Leu Tyr
      60                               65                               70

act ctt tac ttt ggt tcc atg cct acc gtt gtt gca tcc act cct gac 352
Thr Leu Tyr Phe Gly Ser Met Pro Thr Val Val Ala Ser Thr Pro Asp
      75                               80                               85

ttg ttt aaa ctt ttc ctt caa acc cat gaa gct act tcc ttt aac aca 400
Leu Phe Lys Leu Phe Leu Gln Thr His Glu Ala Thr Ser Phe Asn Thr
      90                               95                               100

aga ttc caa acc tct gct att agt cgt ctt acc tat gac aac tct gtt 448
Arg Phe Gln Thr Ser Ala Ile Ser Arg Leu Thr Tyr Asp Asn Ser Val
      105                               110                               115

gct atg gtt cca ttt gca cct tat tgg aag ttt att aga aag ctt atc 496
Ala Met Val Pro Phe Ala Pro Tyr Trp Lys Phe Ile Arg Lys Leu Ile
      120                               125                               130                               135

atg aac gac ttg ctc aac gcc acc act gtt aac aaa ttg agg cca ttg 544
Met Asn Asp Leu Leu Asn Ala Thr Thr Val Asn Lys Leu Arg Pro Leu
      140                               145                               150

agg agc cga gaa atc ctt aag gtt ctt aag gtc atg gct aat agt gct 592
Arg Ser Arg Glu Ile Leu Lys Val Leu Lys Val Met Ala Asn Ser Ala
      155                               160                               165

gaa act caa cag cca ctt gat gtc act gag gag ctt ctc aag tgg aca 640
Glu Thr Gln Gln Pro Leu Asp Val Thr Glu Glu Leu Leu Lys Trp Thr
      170                               175                               180

aac agc aca atc tct acc atg atg ttg ggt gag gcc gaa gag gtt aga 688
Asn Ser Thr Ile Ser Thr Met Met Leu Gly Glu Ala Glu Glu Val Arg
      185                               190                               195

gat att gct cgt gat gtt ctt aag atc ttt gga gaa tat agt gtt aca 736
Asp Ile Ala Arg Asp Val Leu Lys Ile Phe Gly Glu Tyr Ser Val Thr
      200                               205                               210                               215

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aac ttt att tgg cct ttg aac aag ttt aag ttt gga aac tat gat aag	784
Asn Phe Ile Trp Pro Leu Asn Lys Phe Lys Phe Gly Asn Tyr Asp Lys	
220 225 230	
aga act gag gag att ttc aat aag tat gat cct atc att gaa aag gtt	832
Arg Thr Glu Glu Ile Phe Asn Lys Tyr Asp Pro Ile Ile Glu Lys Val	
235 240 245	
atc aag aaa cga caa gag att gtg aac aaa aga aaa aat gga gaa atc	880
Ile Lys Lys Arg Gln Glu Ile Val Asn Lys Arg Lys Asn Gly Glu Ile	
250 255 260	
gta gaa ggc gag cag aat gtt gtt ttt ctt gac act ttg ctt gaa ttt	928
Val Glu Gly Glu Gln Asn Val Val Phe Leu Asp Thr Leu Leu Glu Phe	
265 270 275	
gca caa gat gag acc atg gag atc aaa att aca aag gaa caa atc aag	976
Ala Gln Asp Glu Thr Met Glu Ile Lys Ile Thr Lys Glu Gln Ile Lys	
280 285 290 295	
ggc ctt gtt gtg gat ttt ttc tct gca gga aca gac tcc acc gcc gtg	1024
Gly Leu Val Val Asp Phe Phe Ser Ala Gly Thr Asp Ser Thr Ala Val	
300 305 310	
tct aca gaa tgg act tta tca gag ctc atc aat aat cct aga gtg ttg	1072
Ser Thr Glu Trp Thr Leu Ser Glu Leu Ile Asn Asn Pro Arg Val Leu	
315 320 325	
aag aaa gct cga gag gag att gac tct gtt gtg gga aaa gat aga ctg	1120
Lys Lys Ala Arg Glu Glu Ile Asp Ser Val Val Gly Lys Asp Arg Leu	
330 335 340	
gtt gat gaa tca gat gtt cag aat ctt cct tac att aaa gcc atc gta	1168
Val Asp Glu Ser Asp Val Gln Asn Leu Pro Tyr Ile Lys Ala Ile Val	
345 350 355	
aaa gaa gca ttt cgc ttg cac cca cca cta cct gta gtc aaa aga aaa	1216
Lys Glu Ala Phe Arg Leu His Pro Pro Leu Pro Val Val Lys Arg Lys	
360 365 370 375	
tgt aca caa gaa tgt gag atc gac ggg tat gtg gtt cca gaa gga gca	1264
Cys Thr Gln Glu Cys Glu Ile Asp Gly Tyr Val Val Pro Glu Gly Ala	
380 385 390	
cta ata ctt ttc aat gtc ttg gca gtg gga aga gac cca aaa tat ttg	1312
Leu Ile Leu Phe Asn Val Trp Ala Val Gly Arg Asp Pro Lys Tyr Trp	
395 400 405	
gta aag cca ttg gaa ttt cgt cca gag agg ttc ata gaa aat gtt ggt	1360
Val Lys Pro Leu Glu Phe Arg Pro Glu Arg Phe Ile Glu Asn Val Gly	
410 415 420	
gaa ggt gaa gca gct tca att gat ctt agg ggt caa cat ttc aca ctt	1408
Glu Gly Glu Ala Ala Ser Ile Asp Leu Arg Gly Gln His Phe Thr Leu	
425 430 435	

cta cca ttt ggg tct gga aga agg atg tgt cct gga gtc aat ttg gct 1456  
 Leu Pro Phe Gly Ser Gly Arg Arg Met Cys Pro Gly Val Asn Leu Ala  
 440 445 450 455

act gca gga atg gcc aca atg att gca tct att atc caa tgc ttc gat 1504  
 Thr Ala Gly Met Ala Thr Met Ile Ala Ser Ile Ile Ile Gln Cys Phe Asp  
 460 465 470

ctc caa gta cct ggt caa cat gga gaa ata ttg aat ggt gat tat gct 1552  
 Leu Gln Val Pro Gly Gln His Gly Glu Ile Leu Asn Gly Asp Tyr Ala  
 475 480 485

aag gtt agc atg gaa gag aga cct ggt ctc aca gtt cca agg gca cat 1600  
 Lys Val Ser Met Glu Glu Arg Pro Gly Leu Thr Val Pro Arg Ala His  
 490 495 500

aat ctc atg tgt gtt cct ctt gca aga gct ggt gtc gca gat aaa ctt 1648  
 Asn Leu Met Cys Val Pro Leu Ala Arg Ala Gly Val Ala Asp Lys Leu  
 505 510 515

ctt tcc tcc taaaatatct tgagaggatg aatcaccaac atatagcctc 1697  
 Leu Ser Ser  
 520

tctttgttac tacaaaatta tgatgtaatt ttcttatttt ttctgtcaca aaggaagtgt 1757

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<212> PRT

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Met Leu Val Glu Leu Ala Val Thr Leu Leu Leu Ile Ala Leu Phe Leu  
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His Leu Arg Pro Thr Pro Thr Ala Lys Ser Lys Ala Leu Arg His Leu  
 20 25 30

Pro Asn Pro Pro Ser Pro Lys Pro Arg Leu Pro Phe Ile Gly His Leu  
 35 40 45

His Leu Leu Asp Asn Pro Leu Leu His His Thr Leu Ile Lys Leu Gly  
 50 55 60

Lys Arg Tyr Gly Pro Leu Tyr Thr Leu Tyr Phe Gly Ser Met Pro Thr  
 65 70 75 80

Val Val Ala Ser Thr Pro Asp Leu Phe Lys Leu Phe Leu Gln Thr His  
 85 90 95

Glu Ala Thr Ser Phe Asn Thr Arg Phe Gln Thr Ser Ala Ile Ser Arg  
 100 105 110

Leu Thr Tyr Asp Asn Ser Val Ala Met Val Pro Phe Ala Pro Tyr Trp  
 115 120 125  
 Lys Phe Ile Arg Lys Leu Ile Met Asn Asp Leu Leu Asn Ala Thr Thr  
 130 135 140  
 Val Asn Lys Leu Arg Pro Leu Arg Ser Arg Glu Ile Leu Lys Val Leu  
 145 150 155 160  
 Lys Val Met Ala Asn Ser Ala Glu Thr Gln Gln Pro Leu Asp Val Thr  
 165 170 175  
 Glu Glu Leu Leu Lys Trp Thr Asn Ser Thr Ile Ser Thr Met Met Leu  
 180 185 190  
 Gly Glu Ala Glu Glu Val Arg Asp Ile Ala Arg Asp Val Leu Lys Ile  
 195 200 205  
 Phe Gly Glu Tyr Ser Val Thr Asn Phe Ile Trp Pro Leu Asn Lys Phe  
 210 215 220  
 Lys Phe Gly Asn Tyr Asp Lys Arg Thr Glu Glu Ile Phe Asn Lys Tyr  
 225 230 235 240  
 Asp Pro Ile Ile Glu Lys Val Ile Lys Lys Arg Gln Glu Ile Val Asn  
 245 250 255  
 Lys Arg Lys Asn Gly Glu Ile Val Glu Gly Glu Gln Asn Val Val Phe  
 260 265 270  
 Leu Asp Thr Leu Leu Glu Phe Ala Gln Asp Glu Thr Met Glu Ile Lys  
 275 280 285  
 Ile Thr Lys Glu Gln Ile Lys Gly Leu Val Val Asp Phe Phe Ser Ala  
 290 295 300  
 Gly Thr Asp Ser Thr Ala Val Ser Thr Glu Trp Thr Leu Ser Glu Leu  
 305 310 315 320  
 Ile Asn Asn Pro Arg Val Leu Lys Lys Ala Arg Glu Glu Ile Asp Ser  
 325 330 335  
 Val Val Gly Lys Asp Arg Leu Val Asp Glu Ser Asp Val Gln Asn Leu  
 340 345 350  
 Pro Tyr Ile Lys Ala Ile Val Lys Glu Ala Phe Arg Leu His Pro Pro  
 355 360 365  
 Leu Pro Val Val Lys Arg Lys Cys Thr Gln Glu Cys Glu Ile Asp Gly  
 370 375 380  
 Tyr Val Val Pro Glu Gly Ala Leu Ile Leu Phe Asn Val Trp Ala Val  
 385 390 395 400  
 Gly Arg Asp Pro Lys Tyr Trp Val Lys Pro Leu Glu Phe Arg Pro Glu  
 405 410 415

Arg Phe Ile Glu Asn Val Gly Glu Gly Glu Ala Ala Ser Ile Asp Leu  
420 425 430

Arg Gly Gln His Phe Thr Leu Leu Pro Phe Gly Ser Gly Arg Arg Met  
435 440 445

Cys Pro Gly Val Asn Leu Ala Thr Ala Gly Met Ala Thr Met Ile Ala  
450 455 460

Ser Ile Ile Gln Cys Phe Asp Leu Gln Val Pro Gly Gln His Gly Glu  
465 470 475 480

Ile Leu Asn Gly Asp Tyr Ala Lys Val Ser Met Glu Glu Arg Pro Gly  
485 490 495

Leu Thr Val Pro Arg Ala His Asn Leu Met Cys Val Pro Leu Ala Arg  
500 505 510

Ala Gly Val Ala Asp Lys Leu Leu Ser Ser  
515 520